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Maitane Oscoz-Irurozqui, Felipe Ortuño

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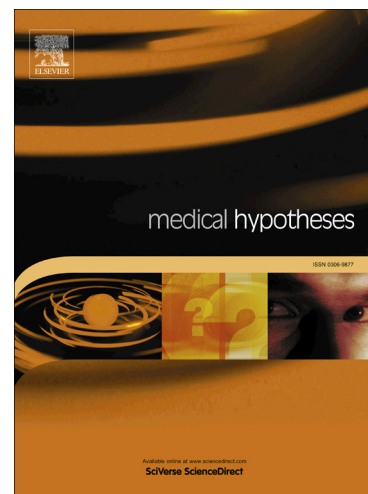
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# Geniuses of medical science: friendly, open and responsible, not mad

**Authors:**

Maitane Oscoz-Irurozqui, M.D.

Felipe Ortuño M.D., Ph.D. Senior Lecturer

**Affiliations:**

Department of Psychiatry and Medical Psychology. Clínica Universidad de Navarra.

C/ PIO XII, 36. 31008 Pamplona, Navarra, Spain

**Tel.:** 34-948255400

**Fax:** 948296500

**Correspondence:** Felipe Ortuño

e-mail: [fortunos@unav.es](mailto:fortunos@unav.es)

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**Abstract**

*Recent studies based on biography analysis provide support for the notion that the prevalence of mental illness in the creative geniuses of art, literature and science is higher than it is in more ordinary folk. However, this relationship between madness and genius, which was also addressed by the classical philosophers, has been generalized to all branches of professional endeavour. Whilst it may hold true for illustrious personalities of the fine arts, we found that the relationship proves inappropriate to the biographies of ten individuals renowned in history for their innovative contributions to medical science. Furthermore, examination of these ten biographies invites the hypothesis that certain personality traits - especially, agreeableness, conscientiousness and openness to new experience- can act to enhance creativity and protect against mental illness.*

**Introduction**

It is a widely held belief that high levels of creativity are associated with a greater risk of suffering certain types of psychopathology, including, personality disorders, schizophrenia spectrum disorders, alcoholism, and, particularly, bipolar disorder. To a large degree, this age-old hypothesis is still going strong today as a result of empirical studies of the biographies of people who are popularly regarded as geniuses for the originality and transcendence of their contributions and works in various fields of knowledge and artistic endeavour. The most thorough of biographical studies is probably that of Post (1994), who examined biographies of 291 illustrious

scientists, composers, politicians, artists, thinkers and writers to conclude that a tight relationship exists between genius and psychopathology.

On the assumption that this hypothesis is true, there have been proposals of models to try to explain the link between creativity and psychopathology. For example, the *shared vulnerability* model of Carson (2011) proposes that "the biological determinants conferring risk for psychopathology interact with protective cognitive factors to enhance creative ideation."

Another model addressing this so-called *mad-genius paradox* formulates the idea that although, in the general population, creative individuals have better mental health than non-creative individuals, those who are extremely creative - a tiny proportion of creative people - do indeed run a higher risk of suffering mental illness. The paradox can be mathematically represented by the discrete Lotka power function (Simonton, 2014).

Other authors link creativity with one specific mental illness, especially bipolar disorder, and then, based on contributions from areas as diverse as palaeoanthropology, information technology and neurobiology, they argue that the mental mechanisms used in the creative resolution of problems are similar to those that occur in manic or hypomanic thought (Ricciardiello and Fornaro, 2012).

However, returning to the biographic studies that inspired these models, we observed on the one hand that the data about the prevalence of mental illness vary by profession and branch of knowledge studied and on the other hand that, when it comes to delimiting personality and mental illness, the studies have arbitrarily regarded peculiarities in behaviour as pathological. Peculiarities in behaviour have even erroneously been identified as symptoms of mental illness when they might be better regarded as manifestations of certain exceptional, positive personality traits; contrary to what has been thought, is it not plausible that these traits can favour creativity and actually protect against mental illness?

### **The hypothesis**

We hypothesize that the *mad-genius paradox* is not relevant to all fields of endeavour. In particular, we hypothesize that scientific geniuses in medicine have no greater vulnerability to mental disorders than the general population. The personalities of these medical geniuses do, however, combine trends in several dimensions of personality, and, on this basis, we propose a model relating creativity to mental health in which each personality factor mediates either scientific creativity, the absence of mental illness, or both of these characteristics.

### **Evaluation of the hypothesis**

We studied, through biographies, autobiographies and publications in indexed journals of medical history, the personality and the presence of psychopathology in ten personages of the history of medicine. Five of these personages: Koch, Bernard,

Pavlov, Pasteur and Röntgen, were included in the previously-mentioned study by Post. We included three Spanish scientists: Marañón, Cajal and Ochoa; Cajal and Ochoa are the only Spanish doctors to have received the Nobel Prize in Physiology or Medicine. Finally, we completed our series with the illustrious English doctor and discoverer of penicillin, Alexander Fleming.

In the event of detecting any evidence of psychopathology, we referred to the most recent version of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) (American Psychiatric Association, 2013). Taking into account previous studies, we paid special attention to the presence of diagnostic criteria for the principle disorders of depression, anxiety, bipolarity, psychosis, substance-related disorders, and personality disorders.

For each biography we estimated the tendency towards one pole or the other for each of the five dimensions of personality as originally defined in, and in terms of the most important attributes described in, the *Big Five personality traits* model (Table 1). To this end, from the biographies, we collected explicit descriptions, that is, the adjectives, used by biographers to describe their subjects, and then subsequently estimated the situation of each personality for each of the five personality factors by comparing descriptions with the definitions and attributes of each personality model.

Under these criteria, only for one of the personages in our sample, Semmelweis, were there unequivocal symptoms of mental disorder. On the basis of symptoms explicitly referred to by his biographers, in the later years of his life, Semmelweis had hallucinations, persecution delusions and disorganized thinking. From a transversal point of view of the symptomatology, Semmelweis' disorder sits in the DSM-5 chapter of schizophrenia spectrum disorders. However, the late onset of psychotic symptoms - Semmelweis was then 47 years old - makes schizophrenia unlikely. The rapid deterioration of his mental condition reported by his biographers suggests the most likely diagnosis to be a psychotic disorder resulting from some other, physical, complaint. The precise nature of this other complaint is less clear; possibilities that have been considered range from Alzheimer's disease to tertiary syphilis.

With regard to personality, Semmelweis' professional career points to marked characteristics in the *conscientiousness* dimension. The central axis around which his life revolved was the laborious search for the cause of puerperal fever. A second set of features correspond to the *openness to experience* dimension. In fact, the drama of Semmelweis' life was his vehement advocacy - despite this being a time before any understanding of bacteria - of a theory that collided with the conventional theory: he hypothesized that all cases of puerperal fever were caused by a lack of hygiene in contrast to the widespread idea of the times that illnesses were propagated by *miasma* (bad air).

The biographers of Semmelweis coincide in affirming that he had little success when it came to communicating his findings and dealing with the fierce opposition that he aroused in colleagues, other eminent scientists and his own boss. It is probable that he was hypersensitive and inadequate in personal relationships. More speculatively, our broadest evaluation of the Semmelweis case is that he had a personality with features of *neuroticism*, which, when exteriorized with impulsive, over-sensitive, excitable and even aggressive behaviour, presented as his antipathy towards colleagues. The delay in recognition of his scientific discovery can be attributed, at least in part, to the difficulties other people had in understanding him and to other problems deriving from his temperament. In fact, his biographers agree that the earliest scientific communications and publications of his findings were the responsibility of collaborators and disciples of his, and that these early reports preceded by a decade his posthumously recognized publication, *Die Ätiologie, der Begriff und die Prophylaxis des Kindbettfiebers* (in which he expounds his theory about the aetiology and prevention of puerperal fever, and which was published in 1861, when he was 43 years old).

In relation to the picture of psychosis that Semmelweis showed towards the end of his life, the patho-biographical information points towards degenerative dementia or some other kind of dementia with an underlying physical cause and not towards primary psychosis in the schizophrenia spectrum of disorders. His scientific contribution was not affected (it was neither jeopardized nor favoured) by his late psychosis: his contributions were made many years before the apparition of any symptoms. In summary, the case of Semmelweis illustrates some aspects of our hypothesis that psychoticism and creativity are, at least in the context of medical science, antagonistic and incompatible.

What about the other scientific geniuses in medicine? The biographical data examined make no indication of the presence of mental disorders in the lives of any of the other nine people studied. Regarding the personality study (Table 1), like Semmelweis, all stood out for their characteristics in the *conscientiousness* and the *openness to experience* dimensions. First, the scientific work of all of them shines for its searching out for new perspectives and for other diverse features of the *openness* dimension, notably, aesthetic sensitivity: most of these scientists cultivated interests in, for example, photography, painting, writing or travel. So, our study corroborates the postulated relationship between creativity and *openness to experience* (Benedeck et. al, 2014). Second, the scientific geniuses studied are noteworthy for their responsibility, trustworthiness, strength of will, perseverance, meticulousness, stamina for work, and scrupulousness in carrying out their research. These characteristics were also pointed out in the aforementioned study by Post

Predominant in these scientists is a greater tendency towards *introversion* (6/10) than *extraversion*. On the whole, they were rather reserved, introspective and even timid, although they enjoyed the company of close friends and family.

The biographies emphasize that practically all of these scientists showed elevated characteristics of *agreeableness*, that is, they stand out in terms of their ability to establish friendly personal relationships; inspire confidence; and be altruistic, considerate, modest and trusting and for these qualities they were much valued by those who enjoyed their friendship. This is the dimension that seems to have been missing from the personality of Semmelweis.

Most of the scientists (8/10) stand out for the imperturbable nature of their character, the high degree of self-control, serenity, and their self-confidence. These are all attributes of the trait *stable* (as opposed to *neurotic*).

Other information that speaks of psychological normality is that most of the scientists got married (9/10), had children (7/9), did not get separated or divorced (7/9), and did not suffer problems of sexual behaviour (9/10). In at least half of the cases there was either early loss of a parent or loss of a child. Although the death of a child was more frequent in the past than it is now, the absence of biographical reports of pathological or depressive grieving suggests that these were stable and resilient people.

Therefore, in contrast to what has been found to be the case for the geniuses of art, music and literature, for at least nine out of ten medical scientists, the hypothesis of an association between genius and psychopathology proves incorrect. Not even in the exceptional case of Semmelweis is the mad genius hypothesis borne out; his special neuroticism and lack of agreeableness (neither of which can be regarded as mental illness) in no way favoured his ground-breaking contributions to medical science but rather meant that his theory was misinterpreted and only came to light later in his life.

The observations made in our study lead us to the hypothesis that certain combinations of personality traits are common to geniuses in the field of medicine. These are factors that can play a modulating role both in creativity and in mental health. The influence is expected to vary according to the dimensional trait: we would consider that heightened *conscientiousness* and *openness to experience* favour scientific creativity, that a lowered degree of *neuroticism* protects against mental illness, and that *agreeableness* favours both creativity and mental health.

### Consequences of the hypothesis

The methods of future studies must deal with the limited availability of information and the subjectivity of biographical works. To this end, and to further test the hypothesis put forward here, it would be interesting to study the personalities of contemporary scientists known for their achievements in medical research (for example, scientists who have been awarded the Nobel Prize in Physiology or Medicine) whilst they are still active. Alternatively, subjects could be limited to illustrious scientists for whom a psychological report, personality test, academic record and medical report are available. The idea would be to see whether the association of traits in personality profiles of scientific geniuses reported here is replicated. Another approach would be to follow up young doctors and researchers with a view to determining whether any particular combination of personality traits is a better predictor of subsequent scientific achievements.

Should our hypothesis be confirmed, it has implications for the realization of potential in scientific creativity and for promotion of mental health, with the latter consideration applying not only to scientists but also to artists, writers and political leaders.

Current psychological thought is that the Five Factors show moderate to high degrees of heritability and tend to be enduring, remaining unchanged over a person's lifetime. Certain minor facets of personality, however, are thought to be better predictors of behaviour than the five main factors themselves. An example of such a minor factor is *friendliness* (which is related to *agreeableness*). If such minor factors are more amenable to change, is it possible that learning and teaching strategies to encourage development of *friendliness*, for example, can help crystallize creative potential into innovative achievement?

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Figure 1. Evaluation in terms of Eysenck's personality model.

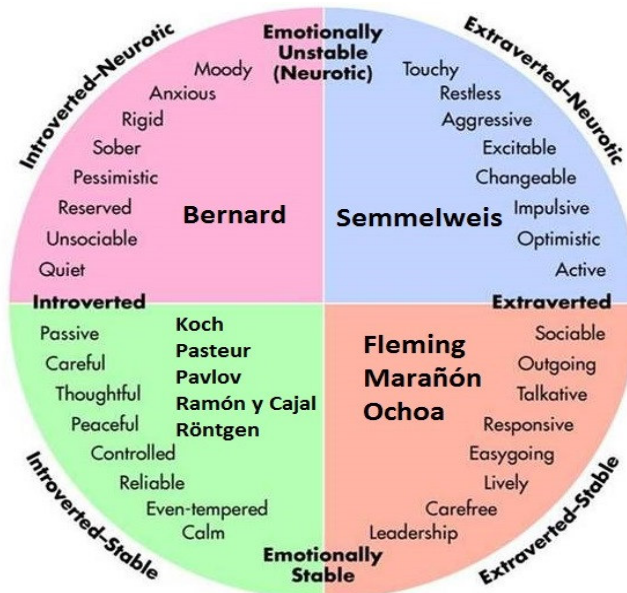


Table 1. Evaluation in terms of the *Big-Five* personality factors.

	Neuroticism	Extraversion	Agreeableness	Conscientiousness	Openness
	m	n	s	ss	s
Bernard	**	-	*	***	***
Fleming	-	**	*	***	***
Koch	-	*	**	***	***
Marañón	-	***	**	***	***
Ochoa	-	**	**	***	***
Pasteur	-	*	**	***	***
Pavlov	-	*	**	***	***
Ramón y Cajal	-	*	**	***	***
Röntgen	-	-	**	***	***
Semmelweis	***	**	-	***	***

- Absent. \* Low. \*\* Medium. \*\*\* High

**Traits associated with each dimension.** **Neuroticism:** anxiety, hostility, depression, self-consciousness, impulsiveness, vulnerability to stress. **Extraversion:** warmth, gregariousness, assertiveness, activity, excitement seeking, positive emotions. **Agreeableness:** trust, straight-forwardness, altruism compliance, modesty, tender-mindedness. **Conscientiousness:** competence, order, dutifulness, achievement striving, self-discipline, deliberation. **Openness to experience:** fantasy, aesthetics, feelings, actions, ideas.